MOELLER

Hardware and Engineering

DE 4-NET-K
Suconet K Interface
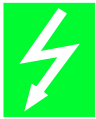
Caution!

Dangerous Electrical Voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.

- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- According to their degree of protection frequency inverters may feature during operation live, bright metal, or possibly moving, rotating parts or hot surfaces.
- The impermissible removal of the necessary covers, improper installation or incorrect operation of motor or frequency inverter may cause the failure of the device and may lead to serious injury or damage.
- The relevant national regulations apply to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).

- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).

- Installations fitted with frequency inverters must be provided with additional monitoring and protective devices in accordance with the relevant safety regulations etc. Modifications to the frequency inverters using the operating software are permitted.

- All shrouds and doors must be kept closed during operation.

- In order to reduce hazards to persons or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:

  - Other independent devices for monitoring safety-related variables (speed, travel, end positions etc.)

  - Electrical or non-electrical system related measures (interlocks or mechanical interlocks).

  - Live parts or cable connections of the frequency inverter must not be touched after it has been disconnected from the power supply due to the charge in capacitors. Appropriate warning signs must be provided.

Contents

Contents

About this Manual

This manual contains the information you need to configure the parameters of the DE 4-NET-K Suconet interface module.

It also contains a description of the function, installation and commissioning of the DE 4-NET-K interface module.

The manual uses the following abbreviations and symbols:

PNU:
Parameter number

☞ | This symbol refers to useful tips and additional information.

▶ This symbol indicates steps of work that you need to carry out.

⚠ | **Attention!**
This symbol warns you about instructions which should be observed to avoid possible damage to equipment, other items in the vicinity or data.

⚠ | **Warning!**
This symbol warns you about instructions which should be observed to avoid possible severe damage to or destruction of equipment, other items in the vicinity or data. It also refers to information which should be observed to avoid possible serious injury or death to operating personnel.

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1 About this Product

System overview

The generic type code for interface modules shows its position among the Klöckner-Moeller family of products:

```
DE4 -  x x x - yyy
```
Number, function
– K = Suconet K

Network module
– NET = Bus interface

Family name
Drives **E**xtensions Generation **4**, extensions, accessories
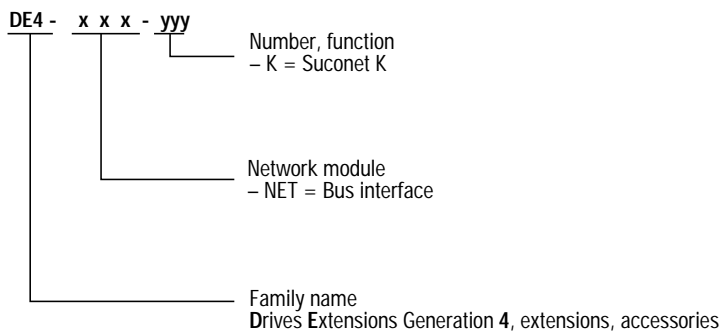
Figure 1: Type code for Suconet K interface modules

The Suconet interface module DE 4-NET-K is used to connect DF 4-34x series frequency inverters to the Suconet K fieldbus. This makes it easy to network them with an automation system. You can then access all frequency inverter parameters from any Suconet K master.

Features of the Suconet interface module

The DE 4-NET-K interface module has the following features:

Hardware interface	RS 485
DIP switch	For selecting bus terminating resistor and Suconet station address
Simple assembly	Yes
Data transfer rate	187.5 kBaud for 600 m data cable 375 kBaud for 300 m data cable

Processing time in frequency inverter:
  Parameter data
  Process data
	30 ms + 20 ms tolerance
	3 ms + 2 ms tolerance

Baud rate detection	Automatic
Diagnostics LEDs	2
Galvanic isolation to Suconet K	Yes
Power feed	From the frequency inverter
Device in Suconet-K line	Slave
Process data exchange	Cyclic
Access to all parameters	Via parameter channel
Max. number of stations	Depending on type of master

Construction
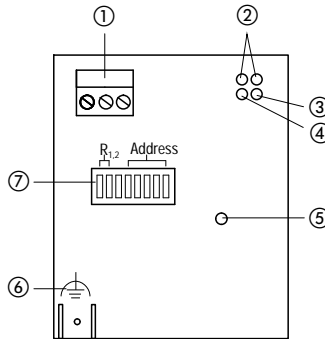
Figure 2: Construction of the DE 4-NET-K Suconet interface module

① Plug-in screw terminals for the Suconet K data cable

② Two operating status LEDs for the frequency inverter

③ Yellow LED for communication status (Suconet bus):
ON = communication to master is active, no faults
OFF = master is in STOP mode, no data exchange
FLASHING = data communication fault, interface module cannot be accessed by the master

④ Yellow LED for the power supply:
ON = interface module and frequency inverter are connected to the power supply.
OFF = no power to interface module - frequency inverter is switched off or not present

⑤ Mounting screw

⑥ PE connection; 6.35 mm spade connector, PE cable min. 2.5 mm^2; avoids communication faults in environments with high electromagnetic interference

⑦ DIP switch
S1, S2 = bus terminating resistor ON/OFF
S3 unused
S4 to S8 = Suconet station address

Manufacturer's certification

The Suconet interface module DE 4-NET-K described in this manual is commonly described in an industrial environment as a "device" or "unit". However the manufacturer would like to point out that is it is not a ready-to-use unit or machine as covered by the relevant Device Safety or EMC regulations or the EC Machinery Directive, and should be classified instead as a component. The intended use is only determined after this component has been connected to other components provided by the user.

Accordingly, compliance of the final construction with existing legal regulations is the responsibility of the user.

Intended use

The interface module DE 4-NET-K may be used as an accessory for the frequency inverter models DF 4-340 and DF 4-341.

The DE 4-NET-K is used to connect the DF 4-series frequency inverter to a higher-level controlling computer (PLC or PC) through Suconet K and functions as a Suconet K Slave.

The interface module may only be used when it is in perfect working order.

Any changes or modifications to the interface module are forbidden.

The interface module described in this manual is intended for use in industrial power installations. It must be rigidly attached to and electrically connected with the frequency inverter in such a way that it meets its intended function when the equipment operates correctly and it does not present any danger to operating personnel.

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It is also necessary to observe all measures which are specified in the manual of the frequency inverter model which is being used.

You may only use the DE 4-NET-K interface module under the specified conditions of use which are described in this manual.

The manual must be made available to operating personnel in its entirety and should be in good readable condition.

During operation of the equipment, the manual should always be available in the vicinity of the interface module for reference by operating personnel.

All personnel who work on or with the interface module DE 4-NET-K must have ready access to the manual during their work.

Read the entire manual carefully before starting the work and observe the relevant information and warnings.

Suitable measures should be provided to ensure that there is no danger to operating personnel or risk of damage to equipment if a failure of the interface module should occur.

All other usage is forbidden.

Persons responsible for safety

At the timepoint of initial delivery, the interface module complies with the current state of the art and is safe to use without exception.

The interface module can present a hazard if:

unskilled persons work on or with the interface module;

The interface module is improperly used.

Operator

The operator is any natural or legal person that uses the interface module or for whom the interface module is used on his/her order.

The operator and/or his/her safety officer must ensure that

all regulations, warnings and national laws are observed;

only qualified personnel are allowed to work on and with the interface module;

this manual is available to operating personnel during all phases of work;

unauthorised persons are prevented from accessing and working on and with the interface module.

Qualified personnel

Qualified personnel includes persons who as a result of their training, experience and instruction and their knowledge of relevant standards, regulations, safety standards and the operational environment have been authorised by the person responsible for the safety of the equipment to perform the required work and are able to recognise and avoid potential dangers (definition of qualified operators from VDE 105 or IEC 364).

Please contact the responsible Klöckner-Moeller Branch Office if you have any questions or problems.

Recycling   The interface module DE 4-NET-K is manufactured from a variety of materials.

The following materials can be recycled:

metal;

plastic;

assembly Instructions.

☞ | The assembled printed circuit board is manufactured from materials which need to be recycled separately.

2 Engineering

The process engineering information and example circuit diagrams described in this manual are suggestions whose suitability for the respective application must be checked by the user.

Attention!
Suitable measures must be implemented to ensure that, if the interface module fails, there is no risk of injury to personnel or damage to equipment.

Connecting to Suconet K

Connect the interface module to the data cable of the Suconet K fieldbus system using the three-pole plug in screw terminals. You can connect further Suconet K stations to the same Suconet line by using the plug-in screw terminals as a T-connector.

Communication with other stations on the bus will not be interrupted if you unplug the screw terminals from the interface module or unplug the interface module from the frequency inverter.

The data cable should be a screened, symmetrically twisted pair of cores (2×0.5 mm^2) (but see also "Potential equalisation" on page 14). The cable impedance must be about 100 to 130 Ω.

Potential equalisation

The data signal earth potential (0 V potential) of the RS 485 interface driver must not deviate by more than ±7 V between interconnected Suconet K stations. If this cannot be guaranteed, you must use a data cable with at least three cores with one spare core to use for potential equalisation. Connect this core to the GND pin on the plug-in screw terminals. If there are two spare cores, connect them in parallel to the GND pin. See "Accessories" on page 52 for cable types. See the manual for the PLC for information on the potential equalisation connection on the PLC.

Pin connections, Suconet K

The RS 485 interface is connected to the three-pin plug in screw terminals as follows:

A   B   GND
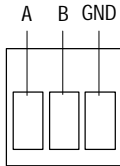
Figure 3: Pin connections for RS 485 interface

Designation	Description
A	RS 485 Suconet K (TA/RA)
B	RS 485 Suconet K (TB/RB)
GND	Connected internally to 0 V potential through a 100 Ω resistor for potential equalization

The GND pin is used for optional potential equalisation.

Networking of several frequency inverters

Networking of the interface modules via the Suconet K interface can be advantageous if the plant contains several frequency inverters..

*Figure 4: Interconnecting several interface modules with
the RS 485 interface*

① Any Suconet K master, e. g. model PS 4, PS 416

☞ Control terminal 28 (controller enable) is always
active and must be connected to HIGH during
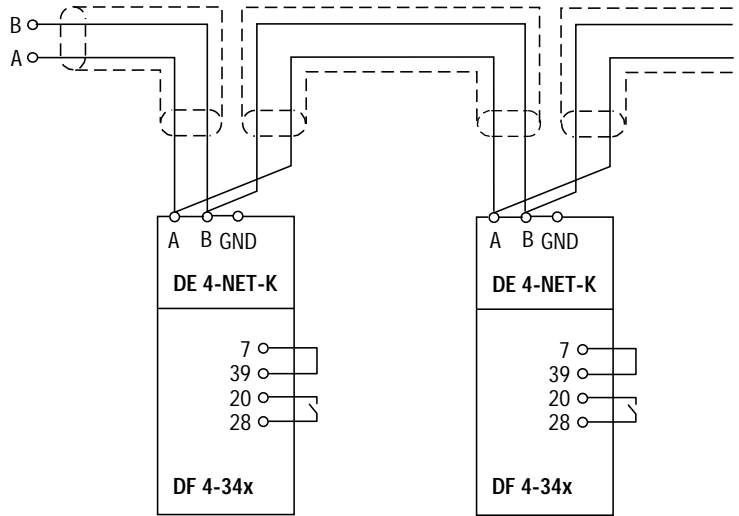operation since it is otherwise not possible to
enable the frequency inverter via the Suconet
interface.

Earthing the data cable screen

Earthing to the mounting plate

For frequency inverters of the DF 4-340 and DF 4-341 series, you can earth the screen of the Suconet data cable to the mounting plate.

☞ If you use a mounting plate which has an insulating layer (e.g. paint, eloxal layer on aluminium), remove the insulation locally to ensure a good earth contact.

▶ Connect the screen of the data cable to the mounting plate using the earthing clip which is provided.
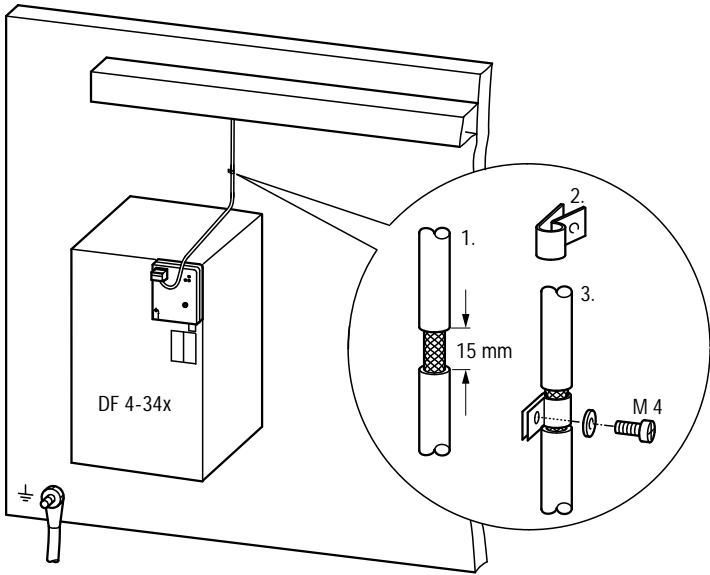
Figure 5: Earthing the Suconet K cable screen to the mounting plate

Earthing to the frequency inverter chassis

▶ Attach the screen of the data cable to the earthing
sheet as shown in the figure and attach the
earthing sheet to a metal surface on the
frequency inverter with a screw.

This method of earthing is suitable for the following
frequency inverter models:

DF 4-340-4K0
DF 4-340-5K5
DF 4-340-7K5
DF 4-340-11K
DF 4-341
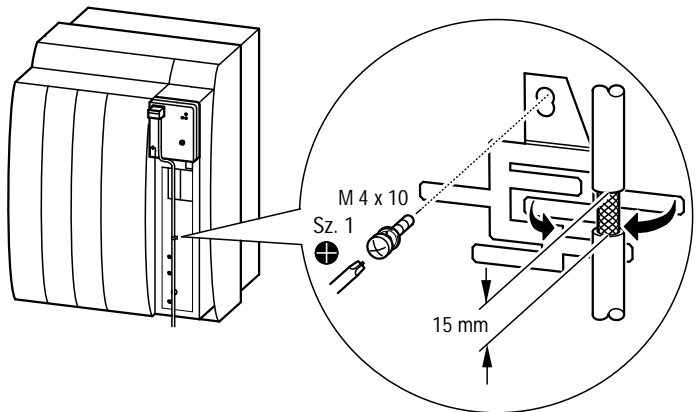
*Figure 6: Earthing the Suconet K cable screen to the
frequency inverter*

Only use screened, twisted pair data cable.

Avoiding electrical interference

Wiring

Warning!
Always lay control, signal and power cables as far apart as possible. This avoids capacitive and inductive interaction. If sufficient spacing between the cables is not possible, you should screen above all the cable producing the interference.

For frequency inverters of the DF 4-34x series, electromagnetic interference can impair the data communication. To ensure reliable data communication:

▶ Keep the connections between the earthing points and the interface module as short as possible.

▶ Avoid laying data cables and power cables adjacently and parallel over longer distances.

▶ Maintain a minimum spacing of 30 cm between the data cables and the power cables.

▶ Use an additional PE cable to interconnect the earths of the interface module and the frequency converter.

08/97 AWB 823-1292-GB

RS 6.3 mm

Cu 2.5 mm^2

PE

DF 4-340-075
DF 4-340-1K5
DF 4-340-2K2
DF 4-340-3K0

Cu 2.5 mm^2

PE

DF 4-340-4K0
DF 4-340-5K5
DF 4-340-7K5
DF 4-340-11K
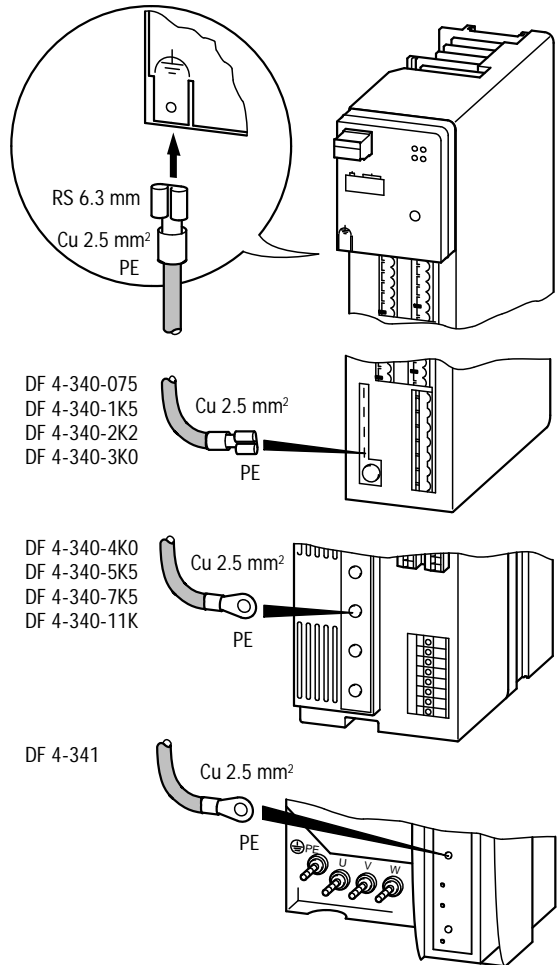
Cu 2.5 mm^2

PE

DF 4-341

Cu 2.5 mm^2

PE

*Figure 7: Avoiding electrical interference by using an
additional PE cable*

3 Assembly

Scope of delivery

After receiving the equipment, check immediately whether the delivered items match the delivery note. Klöckner-Moeller cannot be responsible for claims made at a later date.

The following components are supplied with the interface module:

DE 4-NET-K interface module in case (protection class IP 20)

Mounting kit

Assembly instructions with the reference number AWA 823-1572

Making claims:

If there is any visible transport damage, please contact the supplier immediately.

If there are any visible faults or if some of the items are missing, please contact your local Klöckner-Moeller agent immediately.

Attaching to DF 4 series frequency inverters

Proceed as follows to attach the interface module to the frequency inverter:

▶ Push the interface module carefully onto the front of the frequency inverter until it clicks into place.

▶ Securely attach the interface module to the frequency inverter using the mounting screw provided. Use a size 1 cross-head screw driver.

▶ Provide a PE connection between the frequency inverter and the interface module (min. cable cross-section of the PE cable 2.5 mm^2).

Ensure that the interface module is pushed into place and tightened up without using excessive force.

CLICK!

Sz. 1

M 3 x 30 mm

1 Nm
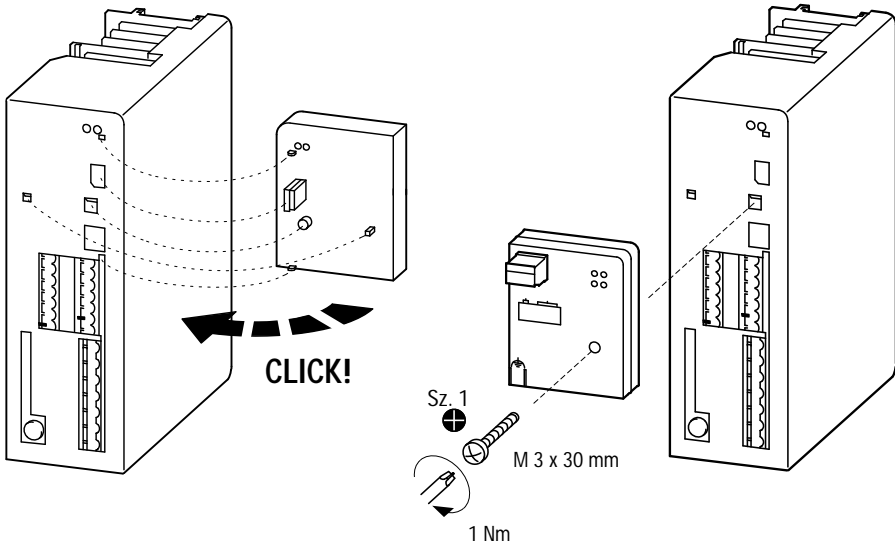
Figure 8: Attaching the DE 4-NET-K interface module to the frequency inverter

Tighten up the mounting screw with the specified torque to ensure a reliable PE connection between the interface module and the frequency inverter.

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Connecting the interface
module to the
Suconet K bus

**Connecting the
interface module to the
Suconet K bus**

Proceed as follows to connect the Suconet K data
cable to the interface module:

▶ Remove the insulation from the cores of the
Suconet K data cable and insert them in the plug-
in screw terminals; tighten up the screws.

▶ Push the plug-in screw terminal block into the
interface module. It should engage with a click.

*Figure 9: Connecting the interface module to the
Suconet K data cable*

① Without cores for potential equalisation: use 2-core
data cable type LT 309.096
With cores for potential equalisation: use 4-core data
cable type LT 309.099.1

4 Hardware Configuration

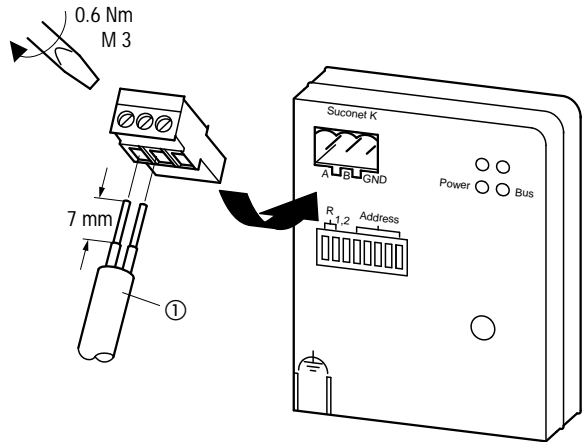Hardware configuration is carried out with a single DIP switchblock. Switches S1 and S2 are used to enable or disable the bus terminating resistor ①. S3 ③ is not used. The station address ② is configured with the switches S4 to S8.

The interface module is supplied pre-configured for bus terminating resistor enabled and the station address 1.
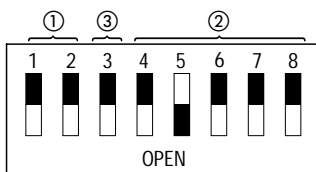
Figure 10: Factory setting of the DIP switch

Configuring the bus terminating resistor

The bus terminating resistor avoids signal distortion caused by signal reflections at the ends of the bus cable.

The bus terminating resistor must be enabled if the interface module is installed at the beginning or end of the Suconet K line.

Attention!
The two switches S1 and S2 for the bus terminating resistor must be both ON or both OFF, since otherwise the bus terminating resistor will be enabled for only one of the two wires of the data cable. In this case, only one of the wires is protected against signal reflection.

Attention!
The bus terminating resistor must be switched OFF if the interface module is not installed at one of the two ends of the Suconet K line (S1 and S2 should both be OFF); otherwise the data signals strength will be reduced.

Configuring the station address

The station address is configured with switches S4 to S8. The interface module must be assigned with a unique station address to allow it to communicate correctly with the master.

▶ Switch off the power feed to the frequency inverter.

▶ Choose a unique station address and set the DIP switches S4 to S8 according to the table below.

▶ Switch on the power to the frequency inverter again. The interface module is now configured with the assigned address.

Warning!
Make sure that the chosen station address has not been already assigned to another station, since otherwise correct communication with the master will not be possible.

Station ID	S4	S5	S6	S7	S8
1	1	0	1	1	1
2	0	0	1	1	1
3	1	1	0	1	1
4	0	1	0	1	1
5	1	0	0	1	1
6	0	0	0	1	1
7	1	1	1	0	1
8	0	1	1	0	1
9	1	0	1	0	1
10	0	0	1	0	1
11	1	1	0	0	1
12	0	1	0	0	1
13	1	0	0	0	1
14	0	0	0	0	1
15	1	1	1	1	0
16	0	1	1	1	0
17	1	0	1	1	0
18	0	0	1	1	0
19	1	1	0	1	0
20	0	1	0	1	0
21	1	0	0	1	0
22	0	0	0	1	0
23	1	1	1	0	0
24	0	1	1	0	0
25	1	0	1	0	0
26	0	0	1	0	0
27	1	1	0	0	0
28	0	1	0	0	0
29	1	0	0	0	0
30	0	0	0	0	0

1 = ON, 0 = OFF

5 Programming

⚠ **Attention!**
DF 4 series frequency inverters have two parameter sets (PAR1, PAR2). Both parameter sets can be accessed through Suconet. Parameters in parameter set PAR2 are accessed by adding an offset of 2000 to the parameter number (see "Parameter number" on page 40 for an example).

⚠ **Attention!**
After switching the power feed to the frequency inverter off and on again, the operating mode parameter PNU 1 is automatically set to "3" ("control via interface") in both parameter sets if the interface module is attached. This is also done if you insert the interface module with power already applied to the frequency inverter. This mode allows the frequency inverter to be fully controlled and configured through Suconet K. Other operating modes do not allow complete control through Suconet K.

Parameters with special significance

Operating mode (PNU 1/PNU 2001)

The parameters for operating mode (PNU 1 and PNU 2001) specify which source (i.e. terminals, LCD keypad or interface module) is able to modify the frequency setpoint and the control word parameters. Parameters can be read through Suconet in all operating modes.

If it should be necessary to operate the frequency inverter in an emergency via the terminals, the operating mode parameters PNU 1 and PNU 2001 can be temporarily set to "1" ("control via terminals") using the Suconet parameter data channel (see

later). Following this, the parameter data channel should be used again to return the values of these parameters to "3" ("control via interface").

Attention!
After switching the power feed to the frequency inverter off and on again, the operating mode parameter PNU 1 is automatically set to "3" ("control via interface") in both parameter sets if the interface module is attached.

The operating mode parameter is available in both parameter sets (i.e. PNU 1 and PNU 2001). For complete control through Suconet K, both PNU 1 and PNU 2001 must always be set to "3".

Reaction to communication errors (PNU 126)

PNU 126 and PNU 2126 are used to specify the reaction of the frequency inverter if communication with the interface module is interrupted (when the interface module is unplugged from the frequency inverter), in order to avoid the frequency inverter from continuing to function without being controlled.

PNU 126/2126 = 0: (factory setting)

If the communication between the frequency inverter and the interface module is interrupted, the frequency inverter retains the current settings and does not trip. An automatic re-initialisation takes place when the communication with the interface module is restored.

PNU 126/2126 = 1:

Following an interruption of communication between the frequency inverter and the interface module, this results in the CEO trip signal. In this case the frequency inverter is set to controller inhibit, i.e. the drive coasts to a halt.

Re-initialisation takes place after the communication with the interface module has been restored and a trip reset has been carried out.

Reaction to interruption of the Suconet bus (PNU 4000)

☞ | This parameter is only available for communication through Suconet K and is thus not described in the manual of the frequency inverter.

⚠ | **Attention!**
Each time power is applied to the system, the interface module sets PNU 4000 to "1" ("controller inhibit"). If another setting is required, this parameter must be reconfigured by the user program each time power is applied.

PNU 4000 specifies the reaction of the frequency inverter if the Suconet K bus is interrupted for more than 300 ms.

PNU 4000 = 0:

No action

PNU 4000 = 1 (factory setting):

Controller inhibit, the motor coasts to a halt

PNU 4000 = 2:

"Quickstop", the motor brakes to a stop using the quickstop ramp. This is then followed by controller inhibit.

Setting parameters through Suconet K

When communicating with a frequency inverter through Suconet K using the Suconet interface module, the data to be transferred can be subdivided into process data and parameter data.

Process data

Process data is the time critical data from the process (i.e. the variable speed drive). Such data often changes rapidly and needs to be up to date. Process data is continuously transferred without needing to be explicitly requested. The following process data is transferred within a data telegram:

Process output data, i.e. data sent to the drive, such as control word, frequency setpoint

Process input data, i.e. data received from the drive, such as status word, actual frequency

The process data channel occupies the first four bytes of the input and output data telegrams (see tables on page 34).

Parameter data

Parameter data is used to configure and monitor the frequency inverter. In contrast to process data, it is only transferred on request. Nearly all parameters of the frequency inverter are transferred via the parameter channel. The only exception are parameters which are assigned to process data (see "Process parameters" in "Parameter list" on page 53).

Information on whether the specified parameter
should be read or written is specified in the
command byte. The parameter data channel
occupies the last eight bytes of the input and output
data telegrams. Its structure is the same for both
directions of data transfer.

☞ Parameters which are transferred via the process
data channel must not be written to via the
parameter data channel (see "Process
parameters" in "Parameter list" on page 53)

**Location of the data in
the Suconet K
memory area**

The interface module DE 4-NET-K is a passive
Suconet K slave with 12 bytes of send data and 12
bytes of receive data. Data access takes place with
the operands SD[size] and RD[size]. The operand
syntax is as follows if the interface module is
configured for Suconet line 1 station 1:

Output data, data to the frequency inverter:
SDB 1.1.0.0 to SDB 1.1.0.11

Input data, data from the frequency inverter:
RDB 1.1.0.0 to RDB 1.1.0.11

Data is read and written for other Suconet K station
addresses in an analogous way. The first two
operand indices specify the Suconet K line and the
Suconet station address, respectively.

Send telegram (to frequency inverter)

x = Line y = Station	Data type	Data contents
SDB x.y.0.0	Process output data	Control word low byte
SDB x.y.0.1		Control word high byte
SDB x.y.0.2		Frequency setpoint low byte
SDB x.y.0.3		Frequency setpoint high byte
SDB x.y.0.4	Parameter data	Command byte
SDB x.y.0.5		Subindex
SDB x.y.0.6		Parameter number low byte
SDB x.y.0.7		Parameter number high byte
SDB x.y.0.8		Parameter value byte 0
SDB x.y.0.9		Parameter value byte 1
SDB x.y.0.10		Parameter value byte 2
SDB x.y.0.11		Parameter value byte 3

Receive telegram (from frequency inverter)

x = Line y = Station	Data type	Data contents
RDB x.y.0.0	Process input data	Status word low byte
RDB x.y.0.1		Status word high byte
RDB x.y.0.2		Output frequency low byte
RDB x.y.0.3		Output frequency high byte
RDB x.y.0.4	Parameter data	Command byte
RDB x.y.0.5		Subindex
RDB x.y.0.6		Parameter number low byte
RDB x.y.0.7		Parameter number high byte
RDB x.y.0.8		Parameter value/Error code byte 0
RDB x.y.0.9		Parameter value/Error code byte 1
RDB x.y.0.10		Parameter value/Error code byte 2
RDB x.y.0.11		Parameter value/Error code byte 3

Process data channel   **Process output data**

Control word

The control word (PNU 135) contains bit-mapped commands for the frequency inverter. The available functions are described in the following table.

PNU 135 Bit	Function for models DF 4-340, DF 4-341
0.1	Bit 1 Bit 0 0 0 Activate frequency setpoint (PNU 046) 0 1 Activate jog frequency 1 (PNU 37) 1 0 Activate jog frequency 2 (PNU 38) 1 1 Activate jog frequency 3 (PNU 39)
2	0 - Clockwise 1 - Anti-clockwise
3	0 - Disable quickstop 1 - Enable quickstop
4	0 - Enable ramp generator 1 - Pause ramp generator
5	0 - Enable ramp generator 1 - Brake ramp generator to setpoint 0 using ramp –a
6	0 - Disable motor potentiometer UP 1 - Enable motor potentiometer UP
7	0 - Disable motor potentiometer DOWN 1 - Enable motor potentiometer DOWN
8	Reserved
9	0 - Enable controller 1 - Disable controller
10	Reserved
11	Edge from 0 to 1 triggers TRIP reset
12	0 - Activate parameter set 1 1 - Activate parameter set 2
13	Reserved
14	0 - Disable DC injection braking 1 - Enable DC injection braking
15	Reserved

The control word is described in detail in the manual for the frequency inverter.

Frequency setpoint

The frequency setpoint is used to specify the required motor speed. The parameter f_{max} is used to specify the maximum admissible output frequency. Valid values are from 0 to ±24000, corresponding to a frequency setpoint of 0 to ±480.0 Hz. A positive sign prefix corresponds to clockwise rotation, and a negative sign prefix corresponds to anti-clockwise rotation of the motor.

Example:

It is necessary to specify a frequency setpoint of 45.5 Hz (clockwise rotation).

$$\frac{24000}{480} \times 45.5 = 2275$$

Write 2275 to SDW x.y.0.2.

Process input data

Status word

The status word (PNU 150) contains bit-mapped information on the current state of the frequency inverter. The following table is a short overview of the status information which is available.

PNU 150 Bit	Function for models DF 4-340, DF 4-341
0	0 - Parameter set 1 active 1 - Parameter set 2 active
1	0 - Frequency inverter enabled 1 - Frequency inverter inhibited
2	0 - Operation below the current limit 1 - Current limit reached
3	0 - Output frequency $\neq$ Frequency setpoint 1 - Output frequency = Frequency setpoint
4	0 - Ramp generator input $\neq$ Ramp generator output 1 - Ramp generator input = Ramp generator output
5	0 - Limit for frequency message not reached ($f_2 < f_1$) 1 - Limit for frequency message reached ($f_2 > f_1$)
6	0 - Output frequency $\neq 0$ 1 - Output frequency = 0
7	0 - Controller enabled 1 - Controller inhibited

8,9,10,11	Bit 11 Bit 10 Bit 9 Bit 8
	  0 0 0 0 Inverter initialization
	  0 0 0 1 Auto-start lockout
	  0 0 1 1 Controller inhibited
	  0 1 0 0 Flying restart option active
	  0 1 0 1 DC injection brake active
	  0 1 1 0 DF 4 read for operation
	  0 1 1 1 Message is available
	  1 0 0 0 Error has occurred

12	0 - Heatsink temperature below warning limit 1 - Heatsink temperature has reached warning limit
13	0 - DC bus voltage normal 1 - Overvoltage in DC bus
14	0 - Clockwise 1 - Anti-clockwise
15	0 - DF 4 not ready for operation 1 - DF 4 ready for operation

☞ The status word (PNU 150) is described in detail in the manual for the frequency inverter.

Output frequency f$_2$

The output frequency of the frequency inverter is the actual field frequency of the motor. Valid values are from 0 to $\pm$24000, corresponding to a motor field frequency of 0 to $\pm$480.0 Hz. A positive sign prefix corresponds to clockwise rotation, and a negative sign prefix corresponds to anti-clockwise rotation.

Example:

RDW x.y.0.2 returns a value of –2500.

$$\frac{480}{24000} \times (-2500) = -50$$

The current output frequency is –50.0 Hz (anti-clockwise rotation).

Exchanging process data

Process data is transferred continuously, provided that the interface module is able to communicate with the master PLC.

Parameter data channel

Parameter values are stored permanently in the frequency inverter even if the power is off. However, process data such as control word or frequency setpoint is not buffered.

The parameter data channel can be used to access all parameters of the frequency inverter with the exception of the process data. The parameter data channel occupies the last eight bytes of the input and output data telegrams. Its structure is the same for both directions of data transfer (see tables on page 34).

Command byte

The command byte is used to specify the command for the frequency inverter and to indicate the response.

Bit	Significance
0, 1	"Service": Command to the frequency inverter Bit 1 bit 0 0 0 no command 0 1 read command (read data from frequency inverter) 1 0 write command (write data to frequency inverter)
2, 3	Reserved
4, 5	"Data length": Length of the data in the field "Parameter value/error code". Bit 5 bit 4 0 0 1 byte 0 1 2 bytes 1 0 3 bytes 1 1 4 bytes
6	"Handshake": Indicates that a new command is available. This bit must be toggled by the master with each new command. The frequency inverter copies the bit to its response telegram. The command has been executed if the bit in the command and response telegrams are identical.
7	"Status": Status information from the frequency inverter to the master for confirmation of the command. It indicates to the master whether the command was carried out without errors. 0 = Command executed without errors. Data in the field "Parameter value/error code" now contains a parameter value. 1 = Command not executed. An error has occurred. Data in byte 0 of the field "Parameter value/error code" now contains an error code.

Subindex

Frequency inverters of the DF 4 series do not have parameters with subindices. Accordingly, the value of this field is always 0.

Parameter number (PNUxxxx)

These two bytes specify the number of the parameter whose value should be written to or read from the frequency inverter.

☞ | You can find more details of the parameters and their admissible values in the appendix and in the manual for the frequency inverter.

DF 4 series frequency inverters have two parameter sets (PAR1, PAR2). Both parameter sets can be accessed through Suconet. Parameters in parameter set PAR2 are accessed by adding an offset of 2000 to the parameter number:

Parameters in PAR1 have parameter numbers from PNU 0000 to PNU 0501

Parameters in PAR2 have parameter numbers from PNU 2000 to PNU 2501

Example for the parameter "maximum frequency":

Parameter set 1: Parameter number = PNU 0011

Parameter set 2: Parameter number = PNU 2011

Parameter value/error code

These four bytes contain the value of the parameter if the command is successful or the error code if the command is unsuccessful. Bit 7 of the command byte (status) indicates whether an error has occurred or not, as follows:

"Status" bit (bit 7) of the command byte = 0

The command was successful and "Parameter value/error code" now contains the parameter value. Some data formats do not require all four bytes. The most common data format for the frequency inverter is a fixed point decimal value with four digits after the decimal point.

☞ The parameter value which is read must be divided by 10,000. The parameter value to be written must first be multiplied by 10,000.

Example:

It is required to write a value of 150.4 s to the parameter PNU 012 (acceleration time).

$150.4 \times 10000 = 1504000_{dez}$ (= $0016F300_{hex}$)

"Status" bit (bit 7) of the command byte = 1
The command was unsuccessful and byte 0 of "Parameter value/error code" now contains an error code (the error code can be read with RDB x.y.0.8). The following table lists the valid error codes:

Value	Significance
0	No error
1	Invalid service
5	Invalid parameter number
6	Inadmissible command parameter (e.g. incorrect subindex)
10	Parameter cannot be written to (e.g. parameter is read only)
14	Inadmissible parameter value (e.g. out of range)

Exchanging parameter data

Reading parameters

▶ Determine the user data area of the Suconet K station (see "Location of the data in the Suconet K memory area" on page 33).

▶ Enter the parameter number in the "Parameter number" field and 0 in the "Subindex" field.

▶ Specify a read command (01_{bin}) with the "Service" bits of the command byte.

▶ Specify the data length in the "Data length" bits of the command byte.

▶ Toggle the "Handshake" bit in the command byte.

▶ Check whether the handshake bit is the same for the Suconet input and output data. It is recommended to include a timeout function in your program.

If the handshake bits are not identical, a response has not yet been received.

If the handshake bits are identical, the response has been received.

▶ Check the "Status" bit in the command byte.

If the "Status" bit is 0, the command was carried out correctly.

If the "Status" bit is 1, the command was not carried out correctly and the "Parameter value/error code" field now contains the error code.

If the command byte and parameter number are identical in the send and receive telegrams, the field "Parameter value/error code" now contains the value or the specified parameter.

Example:

It is required to read the heatsink temperature of a frequency inverter (PNU 0061). The current value is 43 °C.

Command byte

Bit 0 .1 = 1	Read command	(xxxx xx01)
Bit 2. 3 = 0	Reserved	(xxxx 0001)
Bit 4. 5 = 3	Data length 4 bytes	(xx11 0001)
Bit 6 = X	Handshake bit toggles repeatedly	(xx11 0001)
Bit 7 = 0	Only relevant for response	(0x11 0001)

Subindex
Subindex = 0 because parameter PNU 0061 does not have a subindex.

Parameter number
Parameter number = 61 = $00\ 3D_{hex}$

Parameter value
Parameter **value** = 0 (read command)

Send the following command telegram to the frequency inverter:

	Process data channel				Parameter data channel							
	Control word		reqd. value		Com-mand	Sub-index	Parameter number		Parameter value			
SDB x.y.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	0.11
Value	x	x	x	x	0x11 0001$_{bin}$	00$_{hex}$	3D$_{hex}$	00$_{hex}$	00$_{hex}$	00$_{hex}$	00$_{hex}$	00$_{hex}$

Response telegram from the frequency inverter if there are no errors:

	Process data channel				Parameter data channel							
	Status word		actual value		Com-mand	Sub-index	Parameter number		Parameter value			
RDB x.y.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	0.11
Value	x	x	x	x	0x11 0001_{bin}	00_{hex}	$3D_{hex}$	00_{hex}	$B0_{hex}$	$8F_{hex}$	06_{hex}	00_{hex}

Convert the received parameter value:

Parameter value = 00 06 8F $B0_{hex}$ = 430000_{dez} / 10000 = 43.0000. The heating temperature is 43 °C.

Writing to parameters

▶ Determine the user data area of the Suconet K station (see "Location of the data in the Suconet K memory area" on page 33).

▶ Enter the parameter number in the "Parameter number" field and 0 in the "Subindex" field.

▶ Specify the value to write to the parameter in the "Parameter value" field.

▶ Specify a write command (10_{bin}) with the "Service" bits of the command byte.

▶ Specify the data length in the "Data length" bits of the command byte.

▶ Toggle the "Handshake" bit in the command byte.

▶ Check whether the handshake bit is the same for the Suconet input and output data. It is recommended to include a timeout function in your program.

If the handshake bits are not identical, a response has not yet been received.

If the handshake bits are identical, the response has been received.

▶ Check the "Status" bit in the command byte.

> If the "Status" bit is 0 and the command byte and parameter number are identical in the send and receive telegrams, the command was carried out correctly.

> If the "Status" bit is 1, the command was not carried out correctly and the "Parameter value/error code" field now contains the error code.

Example:

It is required to change the acceleration time of the frequency inverter to 20 s (PNU 0012).

Command byte

Bit 0, 1 = 2	Write command	(xxxx xx10)
Bit 2, 3 = 0	Reserved	(xxxx 0010)
Bit 4, 5 = 3	Data length 4 bytes	(xx11 0010)
Bit 6 = X	Handshake bit toggles repeatedly	(xx11 0010)
Bit 7 = 0	Only relevant for response	(0x11 0010)

Subindex
Subindex = 0 because parameter PNU 0012 does not have a subindex.

Parameter number

Parameter number = 12 = 00 0C$_{hex}$

Parameter value

Convert the parameter value for acceleration time

20.00 s = 20 × 10.000 = 200,000 = 00 03 0D 40$_{hex}$

Send the following command telegram to the frequency inverter:

	Process data channel				Parameter data channel							
	Control word		reqd. value		Com-mand	Sub-index	Parameter number		Parameter value			
SDB x.y.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	0.11
Value	x	x	x	x	0x11 0010$_{bin}$	00$_{hex}$	0C$_{hex}$	00$_{hex}$	40$_{hex}$	0D$_{hex}$	03$_{hex}$	00$_{hex}$

Response telegram from the frequency inverter if there are no errors:

	Process data channel				Parameter data channel							
	Status word		Act. value		Com-mand	Sub-index	Parameter number		Parameter value			
RDB x.y.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	0.11
Value	x	x	x	x	0x11 0010$_{bin}$	00$_{hex}$	0C$_{hex}$	00$_{hex}$	40$_{hex}$	0D$_{hex}$	03$_{hex}$	00$_{hex}$

6 Commissioning/Operation/ Diagnostics

Commissioning ☞ | Only operate the Suconet interface module if it is in correct working order.

⚠ | **Warning!**
Before switching on the power, check all wiring for short circuits, earth faults and correct wiring.

Observe the following sequence when commissioning:

▶ First make sure that:

the interface module is correctly plugged in to the frequency inverter and corrected connected up.

each interface module has been configured with a unique station address.

the bus terminating resistors are correctly configured.

▶ Switch on the frequency inverter. The green status LED for the frequency inverter and the yellow power LED for the power supply must both be lit. If this is not the case, refer to "Diagnostics".

▶ Switch the master controller to RUN mode. This starts the PLC program and the yellow bus LED should light up.

Communication is now taking place between the master and the interface module. You can now transfer control and parameter data as necessary.

Operation

To ensure safe operation, refer to the manuals for the master controller and the frequency inverter.

Control terminal 28 (controller enable) is always active and must be connected to HIGH during operation since it is otherwise not possible to enable the frequency inverter via the Suconet interface.

Attention!
After switching the power feed to the frequency inverter off and on again, the operating mode parameter PNU 1 is automatically set to "3" ("control via interface") in both parameter sets if the interface module is attached. This is also done if you insert the interface module with power already applied to the frequency inverter. This mode allows the frequency inverter to be fully controlled and configured through Suconet K. Other operating modes do not allow complete control through Suconet K.

Diagnostics   **Error messages and remedies**

No communication with the frequency inverter

Cause	Remedy

Frequency inverter is switched off
   Green status LED for the frequency inverter is
   not lit up
	Supply power to the frequency inverter (see manual for
	the frequency inverter)

Interface module is not supplied with power Yellow power LED is not lit up	Check correct connection between the frequency inverter and the interface module
A Suconet K error has occurred Yellow power LED is flashing	Switch on master PLC Check station address Check wiring to master PLC
Frequency inverter does not receive telegrams Yellow bus LCD is not lit up	Master PLC is in STOP mode

Appendix

Technical data

Hardware interface	RS 485
Bus	Suconet K
Operating mode	Suconet slave
Network topology	Linear
Baud rate	187.5 or 375 kBaud
Data transfer rate	187.5 kBaud for cable length 600 m 375 kBaud for cable length 300 m (without repeater)
Ambient temperature – operation – transport – storage	0 to +50 °C −25 to +70 °C −25 to +70 °C
Admissible moisture	Relative air humidity max. 80%, no condensation
Power feed	From the frequency inverter
Connection method	Plug-in screw terminals
Cable cross-section	Flexible with ferrule (1 core) 3×0.5 to 1.5 mm^2 Flexible with ferrule (2 cores) 3×0.5 to 1.0 mm^2
Insulation rating: to TTL interface	1000 V DC
Degree of pollution	VDE 0110 part 2 degree of pollution 2
Galvanic isolation to bus system (Suconet K)	Available
Protection class	IP 20

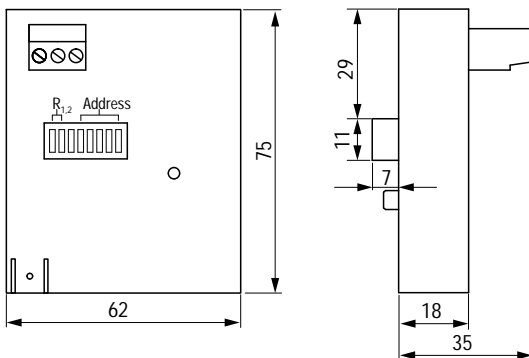**Dimensions** **Interface module DE 4-NET-K**

Figure 11: Front and side view

Accessories The accessories for the DE 4-NET-K interface module which are listed below are optional and must be ordered separately. If necessary, you can get additional technical information on the accessories from your local sales office for Klöckner-Moeller products.

Suconet K data cable	
Cores	2× twisted, isolated, screened
Cable cross-section	0.5 mm^2
Ordering code	Klöckner-Moeller LT 309.096

PROFIBUS data cable (4-core, can be used for additional potential equalisation)

Cores	4× twisted, isolated, screened
Cable cross-section	0.56 mm^2
Ordering code	Klöckner-Moeller LT 309.099.1

S 4/S 40 function module

Your local K-M sales office can provide information on the latest available versions and the respective ordering codes.

Parameter list 👉 Detailed descriptions of the parameters can be found in the manual for the DF 4 frequency inverter series (manual code AWB 823-1278).

●	Parameters can only be read
	Parameter always has the same value in PAR1 and PAR2; you can change the value either in PAR1 or PAR2
Default	Factory setting for DF 4-34x

PAR1	PAR2	Designation	Value range	Default	Comment
1	2001	Operating mode	0 to 3	0	Both parameter sets automatically set to "3" during initialisation
2	2002	Parameter set	0 to 2	0	
4	2004	Switch-on display	0 to 2	0	No function for Suconet
7	2007	Terminal configuration	0 to 22	0	
8	2008	Relay function of relay K1	0 to 10	1	
9	2009	Controller address	1 to 99	1	No function for Suconet
10	2010	Min. output frequency f_{min}	0.00 to 480.0 Hz	0.0 Hz	
11	2011	Max. output frequency f_{max}	7.50 to 480.0 Hz	50 Hz	
12	2012	Acceleration time $+a$	0.00 to 999.0 s	5.0 s	
13	2013	Deceleration time $-a$	0.00 to 999.0 s	5.0 s	
14	2014	Motor control mode	2 to 4	4	
15	2015	U/f rated frequency	7.50 to 960.0 Hz	50 Hz	
16	2016	Voltage boost	0.00 to 40.00%	0%	
17	2017	$f_2 > f_1$	0.00 to 480.0 Hz	0 Hz	
18	2018	Chopper frequency	0 to 5	1	
19	2019	Threshold for auto-DCB	0.10 to 5.0 Hz	0.1 Hz	
21	2021	Slip compensation	0.0 to 20.0%	0%	
22	2022	I_{max} (motor mode)	30 to 150%	150%	
23	2023	I_{max} (generator mode)	30 to 110%	80%	

PAR1	PAR2	Designation	Value range	Default	Comment
34	2034	Setpoint range	0 to 1	0	
36	2036	Voltage for DCB	0.00 to 40.00%	Model	
37	2037	Jog frequency 1	0.00 to 480.0 Hz	20 Hz	
38	2038	Jog frequency 2	0.00 to 480.0 Hz	30 Hz	
39	2039	Jog frequency 3	0.00 to 480.0 Hz	40 Hz	
40	2040	Controller enable	0 to 1	0	Process data
43	2043	TRIP reset	0 to 1	0	Process data
46	2046	Frequency setpoint	0.00 to 480.0	0	Process data
50	2050	Output frequency f_2	–	–	●, process data
52	2052	Motor voltage	–	–	●
54	2054	Motor current	–	–	●
56	2056	Inverter load	–	–	●
61	2061	Heatsink temperature	–	–	●
88	2088	Rated motor current	0.0 to 1.2	Model	
91	2091	Motor cos φ	0.40 to 1.00	Model	
93	2093	Device code	–	–	●
105	2105	Quickstop ramp time $-a_{quick}$	0.00 to 999.0 s	5 s	
106	2106	Holding time for auto-DCB	0.00 to 999.0 s	0.02 s	
108	2108	Gain for PNU 111	0 to 255	128	
111	2111	Monitor signal	0 to 3	0	
117	2117	Relay function of relay K2	0 to 11	0	Only for model DF 4-341
119	2119	Function PTC	0 to 2	0	Only for model DF 4-341
120	2120	I^2t thermal trip	0 to 100%	0%	
125	2125	Baud rate	0 to 4	0	No function for Suconet
126	2126	Reaction to communication error	0 to 1	0	Only available through Suconet, see "Parameter setting"
135	2135	Control word	–	–	Process data
142	2142	Start options	0 to 3	1	
144	2144	Chopper frequency reduction	0 to 1	1	
150	2150	Status word	–	–	●, process data
161	2161	Current fault	–	–	●

PAR1	PAR2	Designation	Value range	Default	Comment
162	2162	Previous fault	–	–	●
163	2163	Last but one fault	–	–	●
164	2164	Last but two fault	–	–	●
170	2170	TRIP reset method	0 to 1	0	
171	2171	Delay for auto TRIP reset	0.00 to 60.00 s	0 s	
178	2178	Running time meter	–	–	●
179	2179	Power-on time meter	–	–	●
500	2500	Display factor for processing speed, numerator	1 to 25000	2000	
501	2501	Display factor for processing speed, denominator	1 to 25000	10	
4000	4000	Reaction to bus interruption	0 to 2	1	Only available through Suconet, see "Parameter setting"

☞ | "Model" signifies that the default is dependent on frequency inverter model.

☞ | The parameters marked with "Process data" must not be written to through the parameter data channel, since they are continuously being exchanged through the parameter data channel.

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